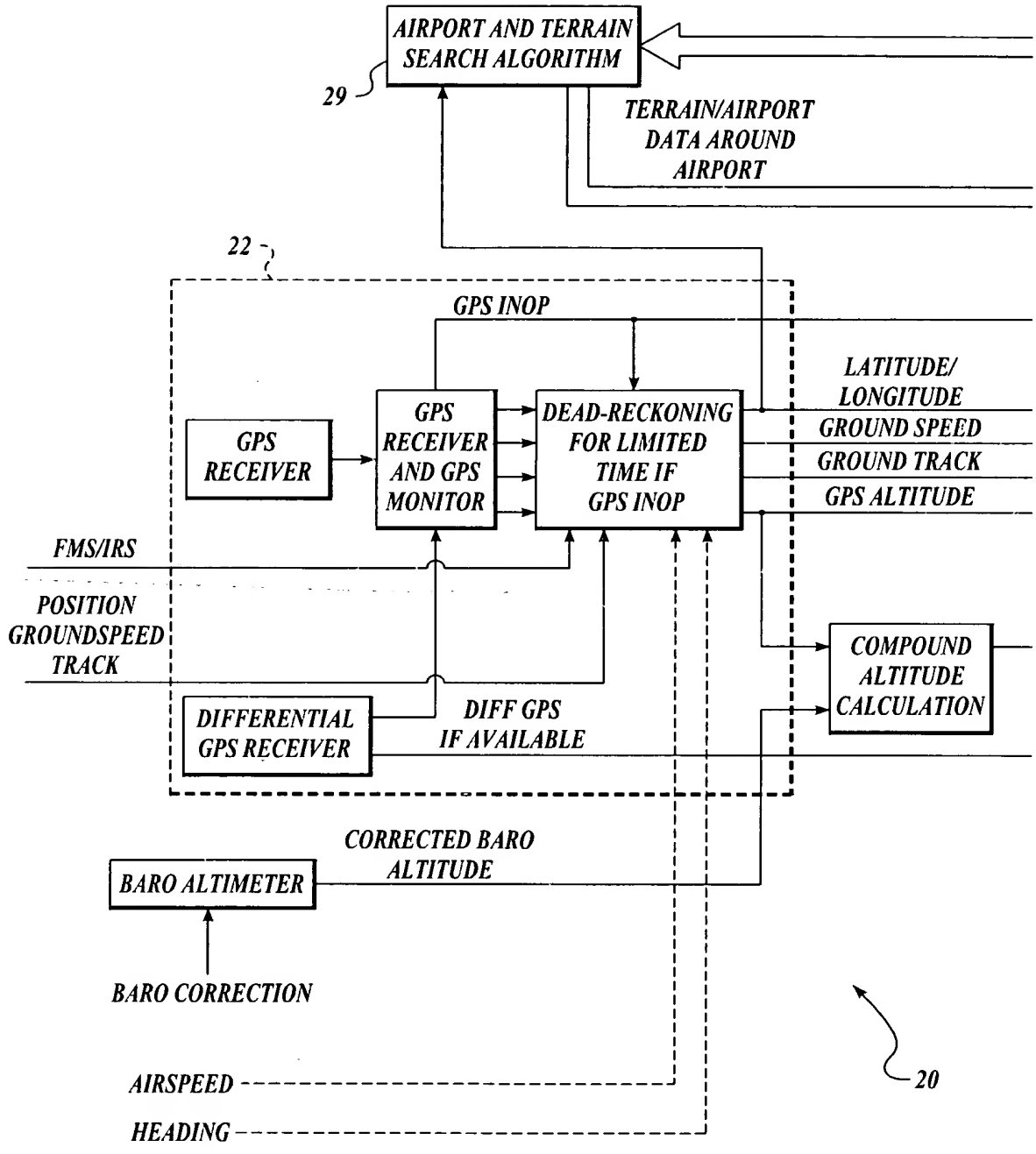

AIRPORT AND TERRAIN SEARCH ALGORITHM
29
TERRAIN/AIRPORT DATA AROUND AIRPORT
22
GPS INOP
GPS RECEIVER
GPS RECEIVER AND GPS MONITOR
DEAD-RECKONING FOR LIMITED TIME IF GPS INOP
LATITUDE/ LONGITUDE
GROUND SPEED
GROUND TRACK
GPS ALTITUDE
FMS/IRS
POSITION GROUNDSPEED TRACK
COMPOUND ALTITUDE CALCULATION
DIFFERENTIAL GPS RECEIVER
DIFF GPS IF AVAILABLE
CORRECTED BARO ALTITUDE
BARO ALTIMETER
BARO CORRECTION
AIRSPEED
HEADING
20

Fig. 1A.

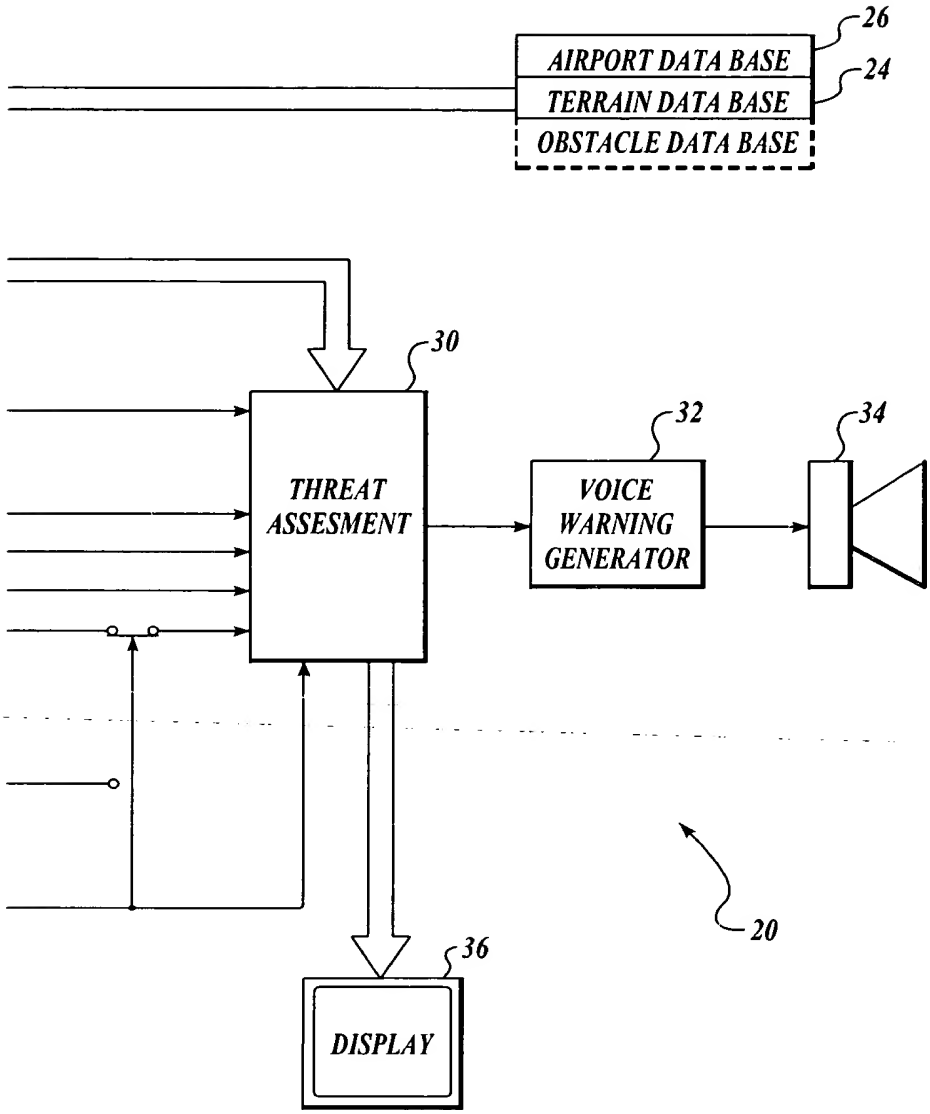

AIRPORT DATA BASE
TERRAIN DATA BASE
OBSTACLE DATA BASE
26
24
30
THREAT ASSESMENT
32
VOICE WARNING GENERATOR
34
36
DISPLAY
20

Fig. 1B.

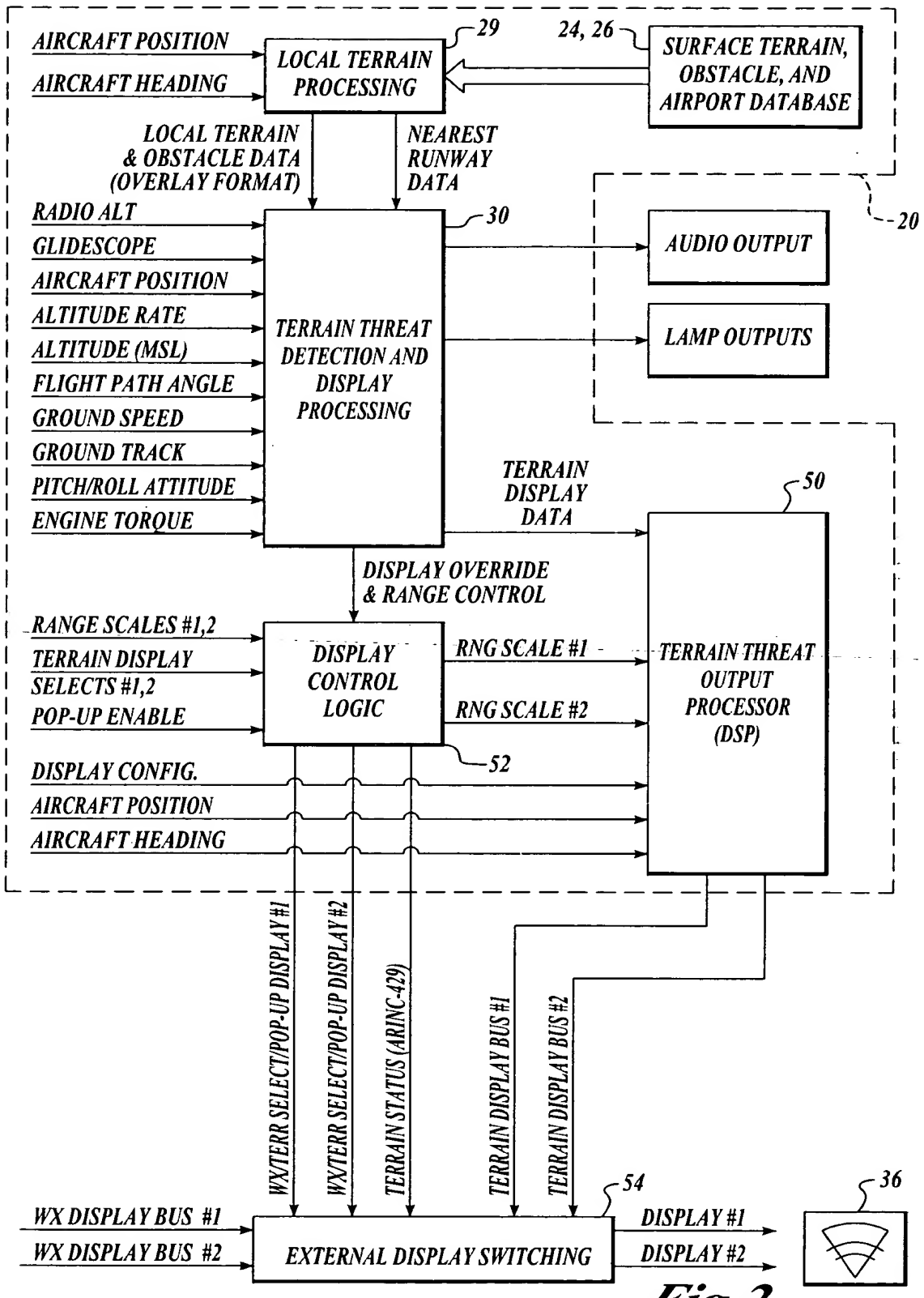

AIRCRAFT POSITION
AIRCRAFT HEADING
LOCAL TERRAIN PROCESSING
29
24, 26
SURFACE TERRAIN, OBSTACLE, AND AIRPORT DATABASE
LOCAL TERRAIN & OBSTACLE DATA (OVERLAY FORMAT)
NEAREST RUNWAY DATA
RADIO ALT
GLIDESCOPE
AIRCRAFT POSITION
ALTITUDE RATE
ALTITUDE (MSL)
FLIGHT PATH ANGLE
GROUND SPEED
GROUND TRACK
PITCH/ROLL ATTITUDE
ENGINE TORQUE
TERRAIN THREAT DETECTION AND DISPLAY PROCESSING
30
AUDIO OUTPUT
LAMP OUTPUTS
20
TERRAIN DISPLAY DATA
50
DISPLAY OVERRIDE & RANGE CONTROL
RANGE SCALES #1,2
TERRAIN DISPLAY SELECTS #1,2
POP-UP ENABLE
DISPLAY CONTROL LOGIC
RNG SCALE #1
RNG SCALE #2
TERRAIN THREAT OUTPUT PROCESSOR (DSP)
52
DISPLAY CONFIG.
AIRCRAFT POSITION
AIRCRAFT HEADING
WX/TERR SELECT/POP-UP DISPLAY #1
WX/TERR SELECT/POP-UP DISPLAY #2
TERRAIN STATUS (ARINC-429)
TERRAIN DISPLAY BUS #1
TERRAIN DISPLAY BUS #2
54
36
WX DISPLAY BUS #1
WX DISPLAY BUS #2
EXTERNAL DISPLAY SWITCHING
DISPLAY #1
DISPLAY #2

Fig.2

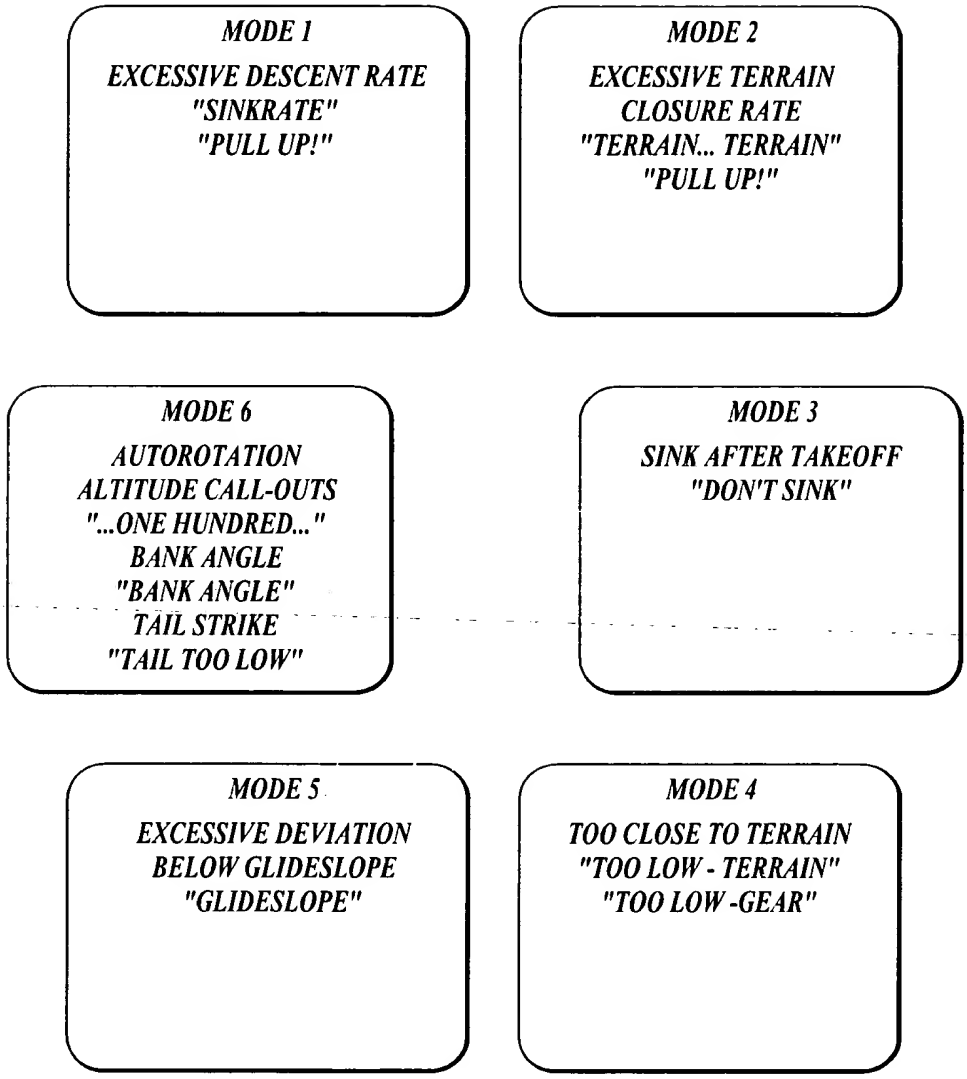
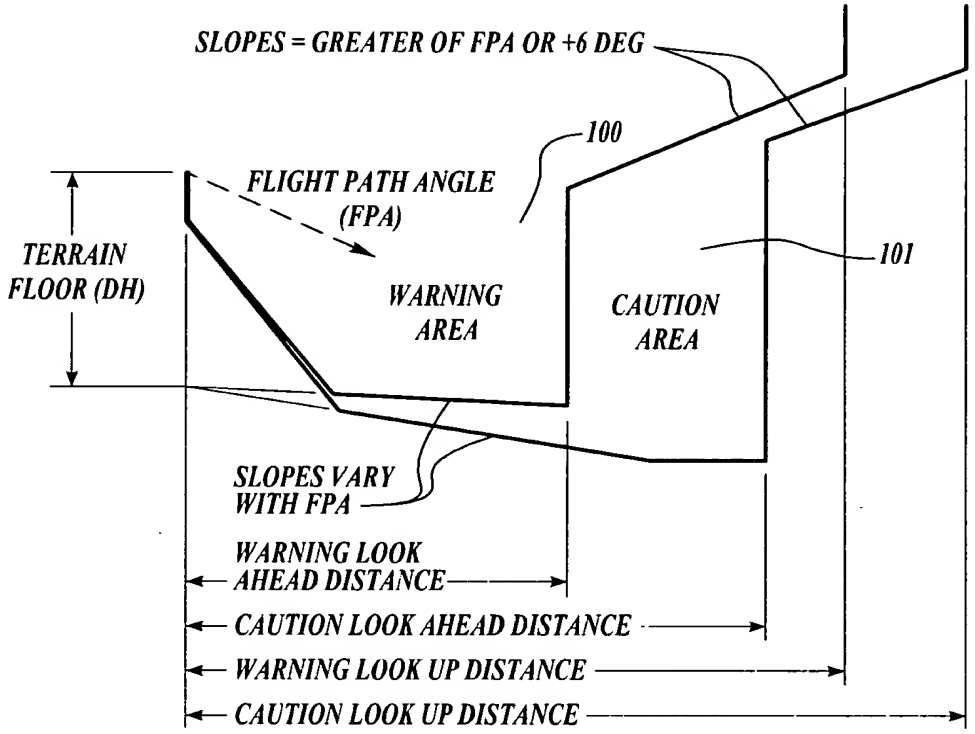


Fig.3

EP 0 965 538 A1



LOOK AHEAD DISTANCES VARY WITH GROUND SPEED AND DISTANCE TO RUNWAY
TERRAIN FLOOR VARIES WITH DISTANCE TO RUNWAY

Fig. 4

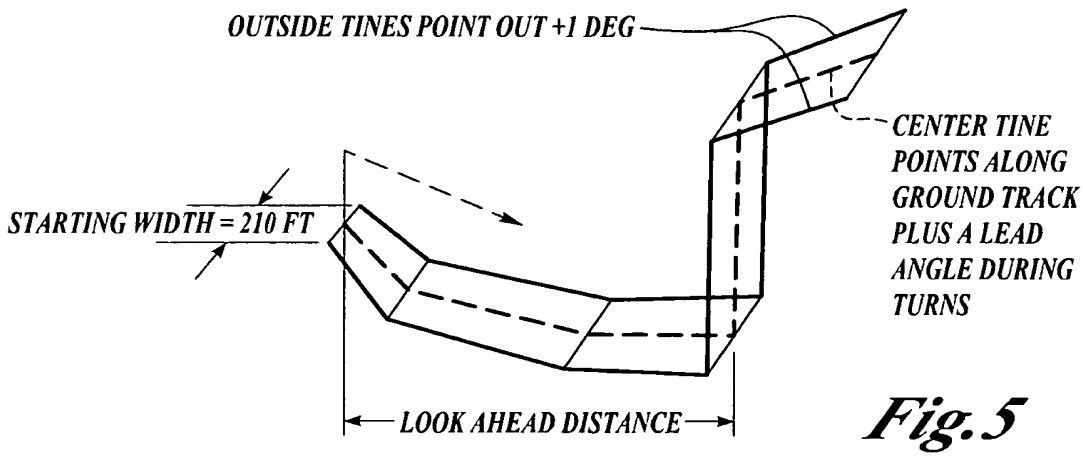


Fig. 5

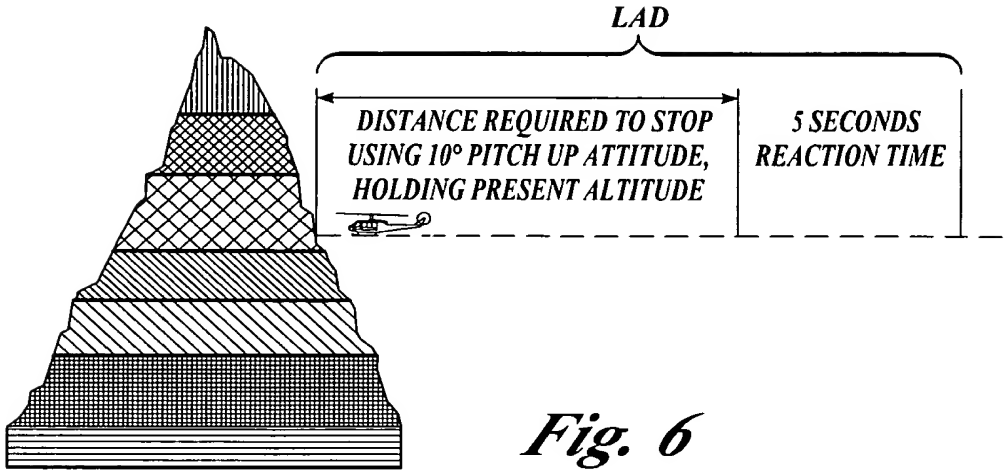


Fig. 6

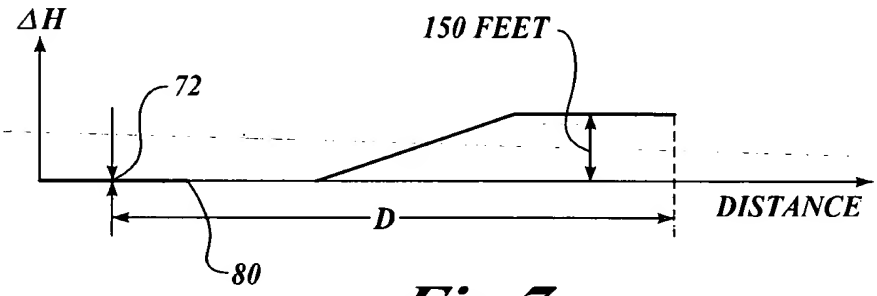


Fig. 7

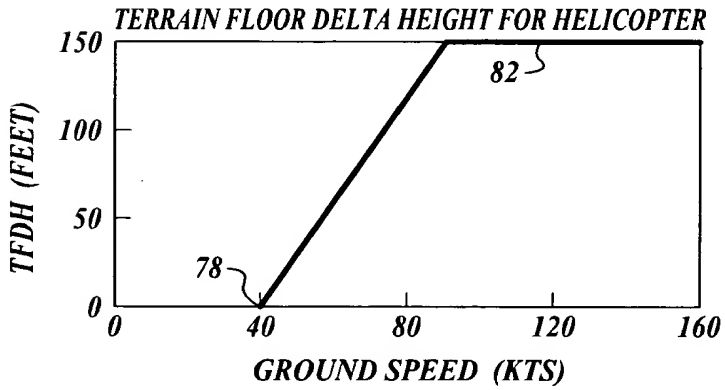


Fig. 8

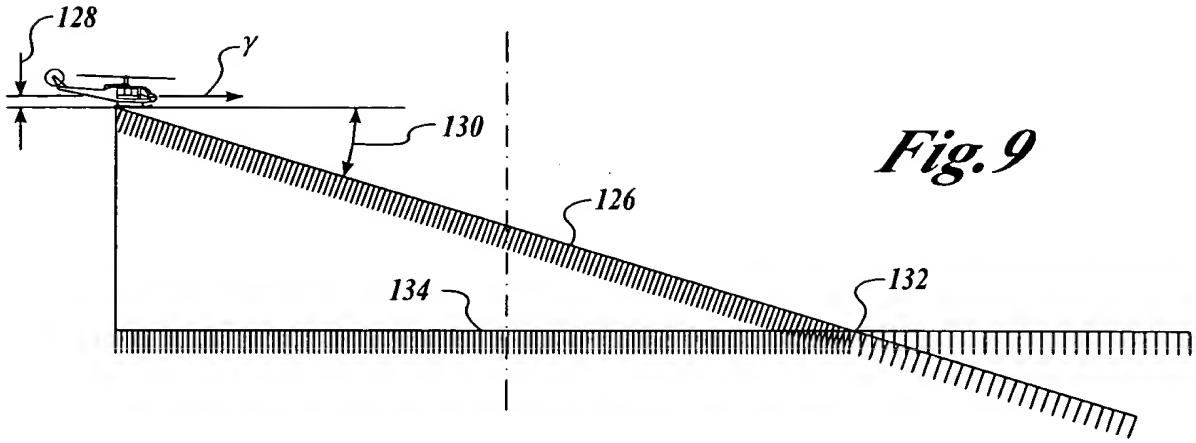


Fig. 9

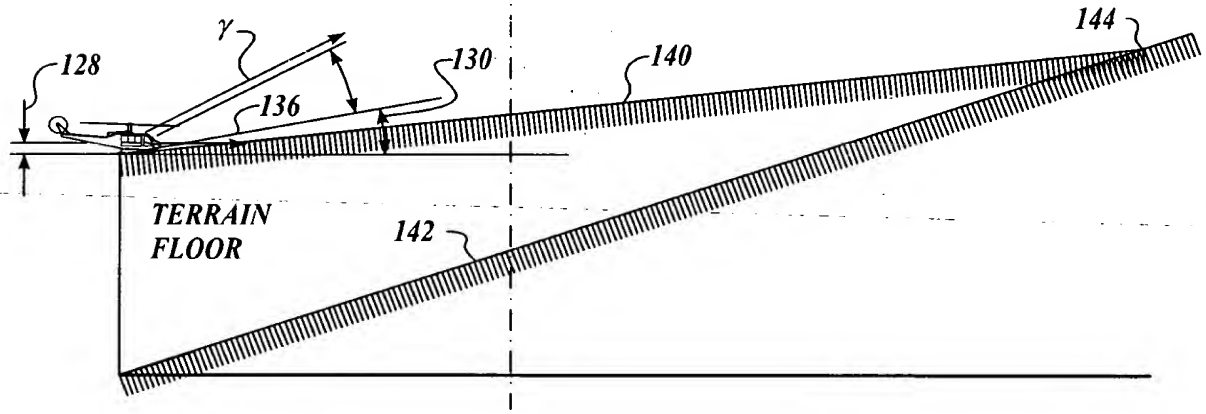


Fig. 10

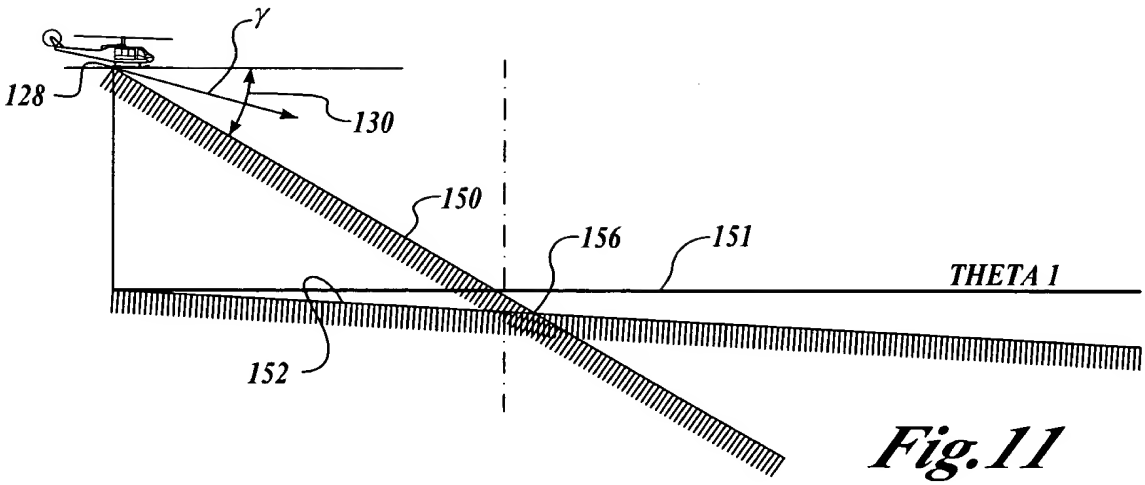


Fig. 11

FACSIMILE COPY

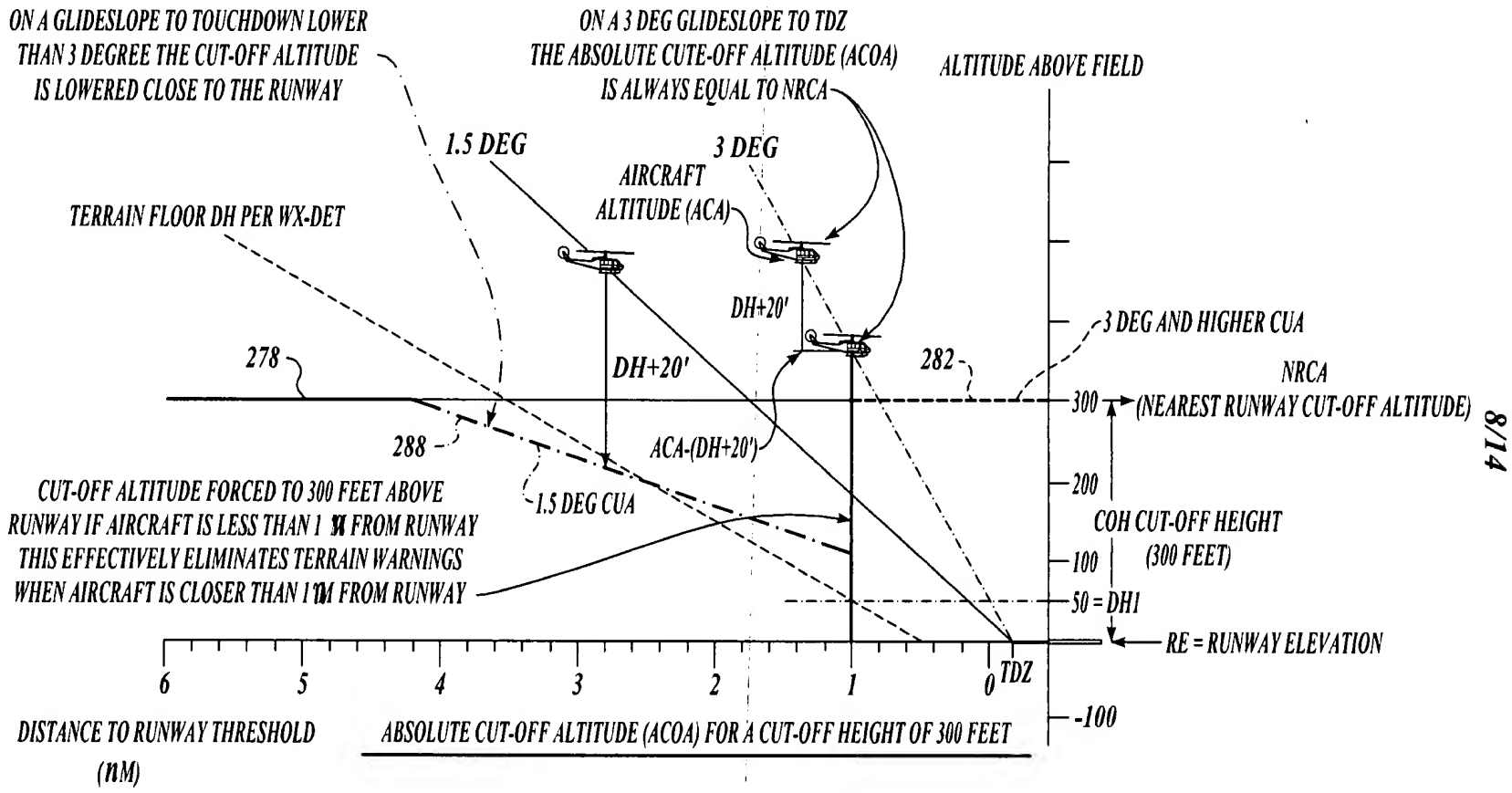

ON A GLIDESLOPE TO TOUCHDOWN LOWER THAN 3 DEGREE THE CUT-OFF ALTITUDE IS LOWERED CLOSE TO THE RUNWAY
ON A 3 DEG GLIDESLOPE TO TDZ THE ABSOLUTE CUTE-OFF ALTITUDE (ACOA) IS ALWAYS EQUAL TO NRCA
ALTITUDE ABOVE FIELD
1.5 DEG
3 DEG
AIRCRAFT ALTITUDE (ACA)
TERRAIN FLOOR DH PER WX-DET
DH+20'
3 DEG AND HIGHER CUA
278
DH+20'
282
NRCA
300
(NEAREST RUNWAY CUT-OFF ALTITUDE)
288
ACA-(DH+20')
200
1.5 DEG CUA
CUT-OFF ALTITUDE FORCED TO 300 FEET ABOVE RUNWAY IF AIRCRAFT IS LESS THAN 1 NM FROM RUNWAY
THIS EFFECTIVELY ELIMINATES TERRAIN WARNINGS WHEN AIRCRAFT IS CLOSER THAN 1 NM FROM RUNWAY
COH CUT-OFF HEIGHT (300 FEET)
100
50 = DH1
RE = RUNWAY ELEVATION
6
5
4
3
2
1
0
TDZ
-100
DISTANCE TO RUNWAY THRESHOLD (NM)
ABSOLUTE CUT-OFF ALTITUDE (ACOA) FOR A CUT-OFF HEIGHT OF 300 FEET

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Fig.12

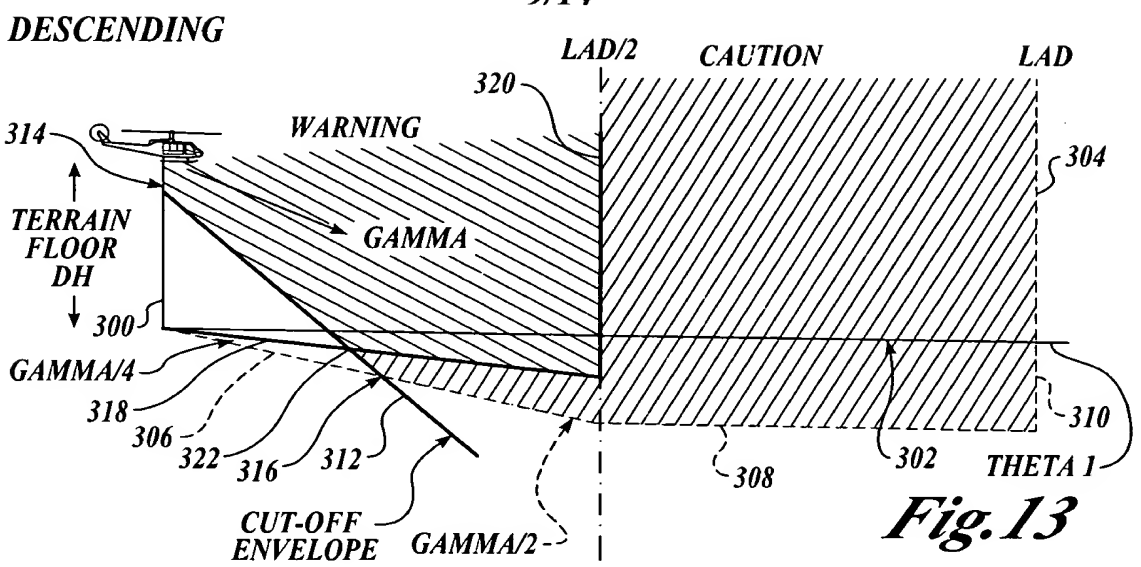

Fig. 13

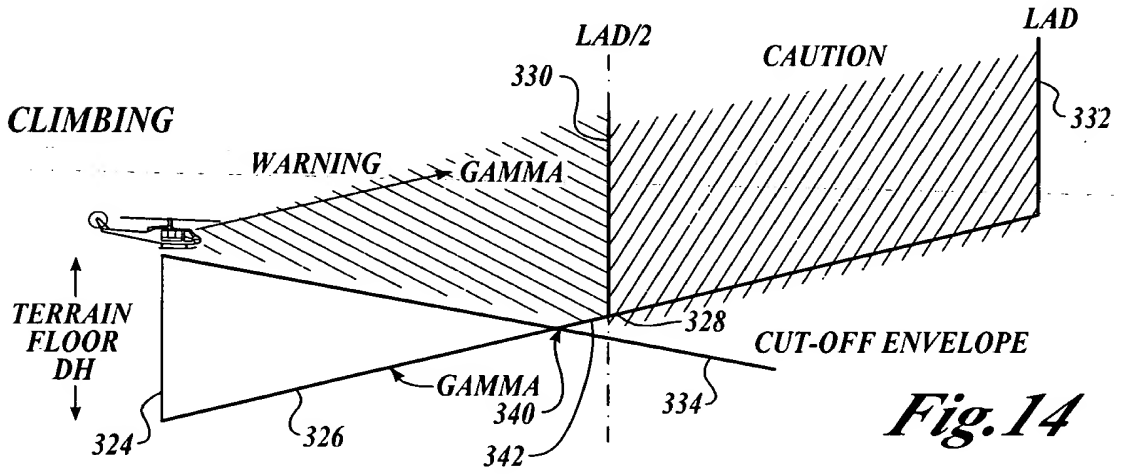

Fig. 14

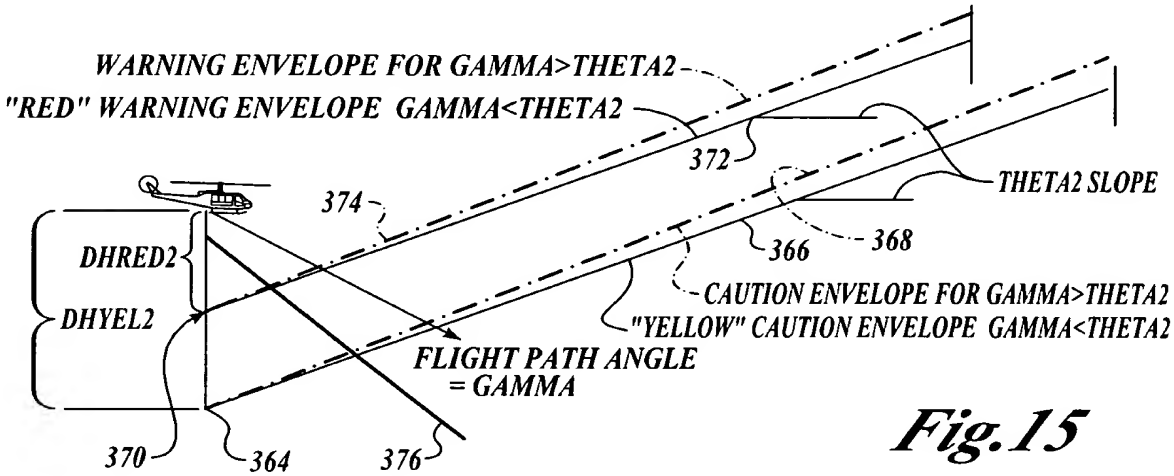

Fig. 15

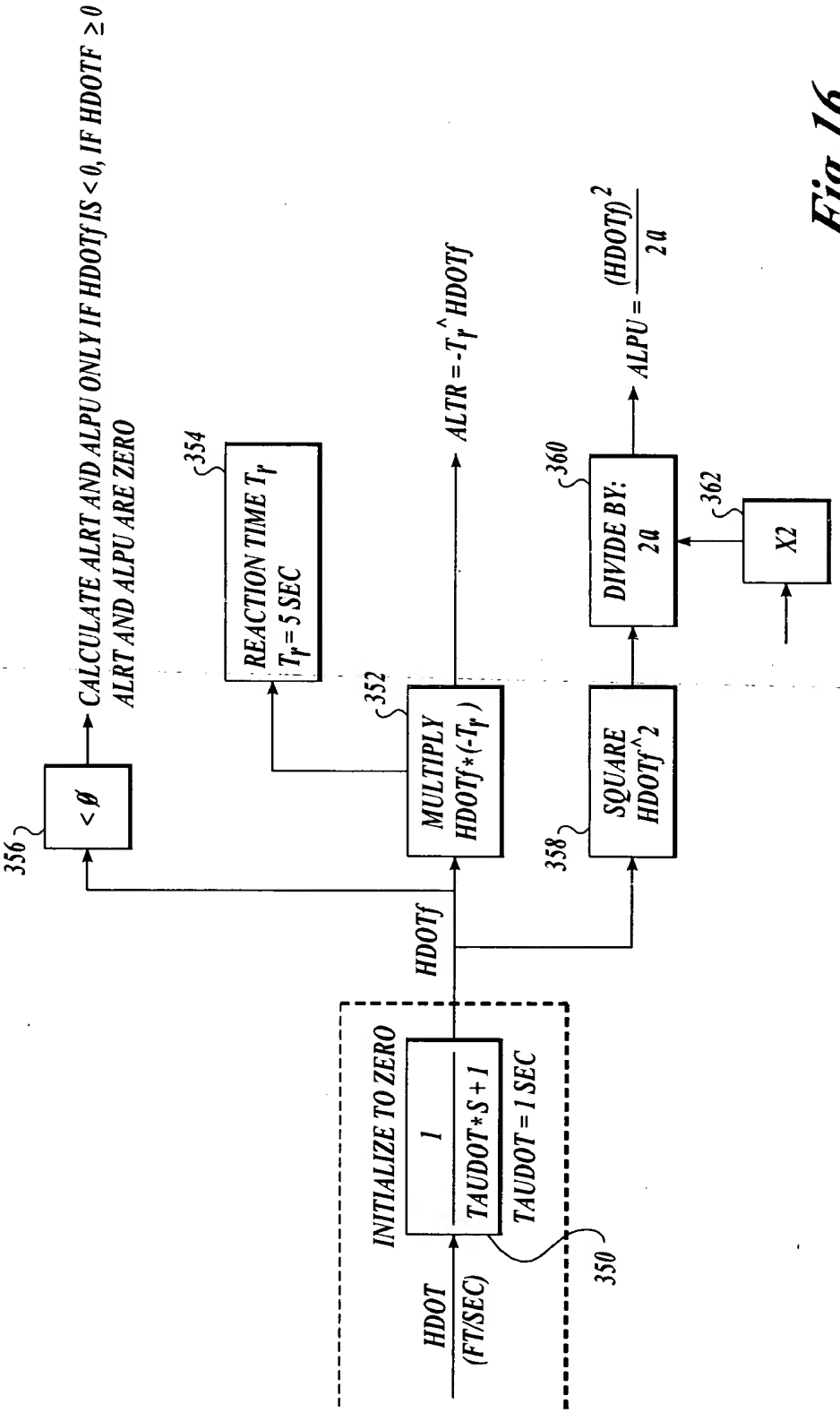
HDOT
(FT/SEC)
INITIALIZE TO ZERO
1
TAUDOT*S+1
TAUDOT = 1 SEC
350
HDOTf
356
< ∅
CALCULATE ALRT AND ALPU ONLY IF HDOTf IS < 0, IF HDOTF ≥ 0
ALRT AND ALPU ARE ZERO
354
REACTION TIME T_r
T_r = 5 SEC
352
MULTIPLY
HDOTf*(-T_r)
ALTR = -T_r ^ HDOTf
358
SQUARE
HDOTf^2
360
DIVIDE BY:
2a
ALPU = $\frac{(HDOTf)^2}{2a}$
362
X2

Fig. 16

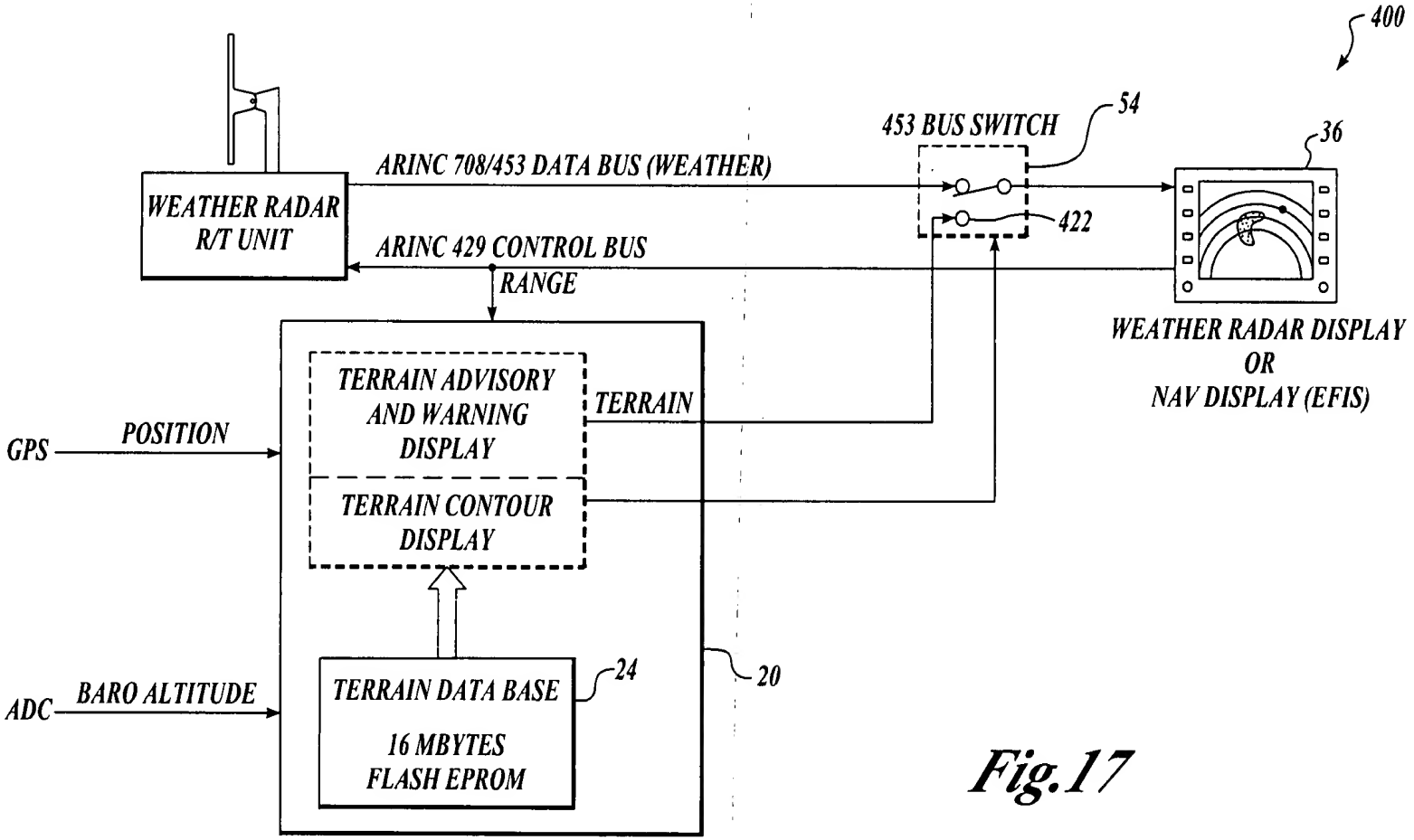
400
453 BUS SWITCH
54
36
ARINC 708/453 DATA BUS (WEATHER)
WEATHER RADAR R/T UNIT
422
ARINC 429 CONTROL BUS
RANGE
WEATHER RADAR DISPLAY OR NAV DISPLAY (EFIS)
TERRAIN ADVISORY AND WARNING DISPLAY
TERRAIN
GPS
POSITION
TERRAIN CONTOUR DISPLAY
ADC
BARO ALTITUDE
TERRAIN DATA BASE
16 MBYTES FLASH EPROM
24
20

Fig.17

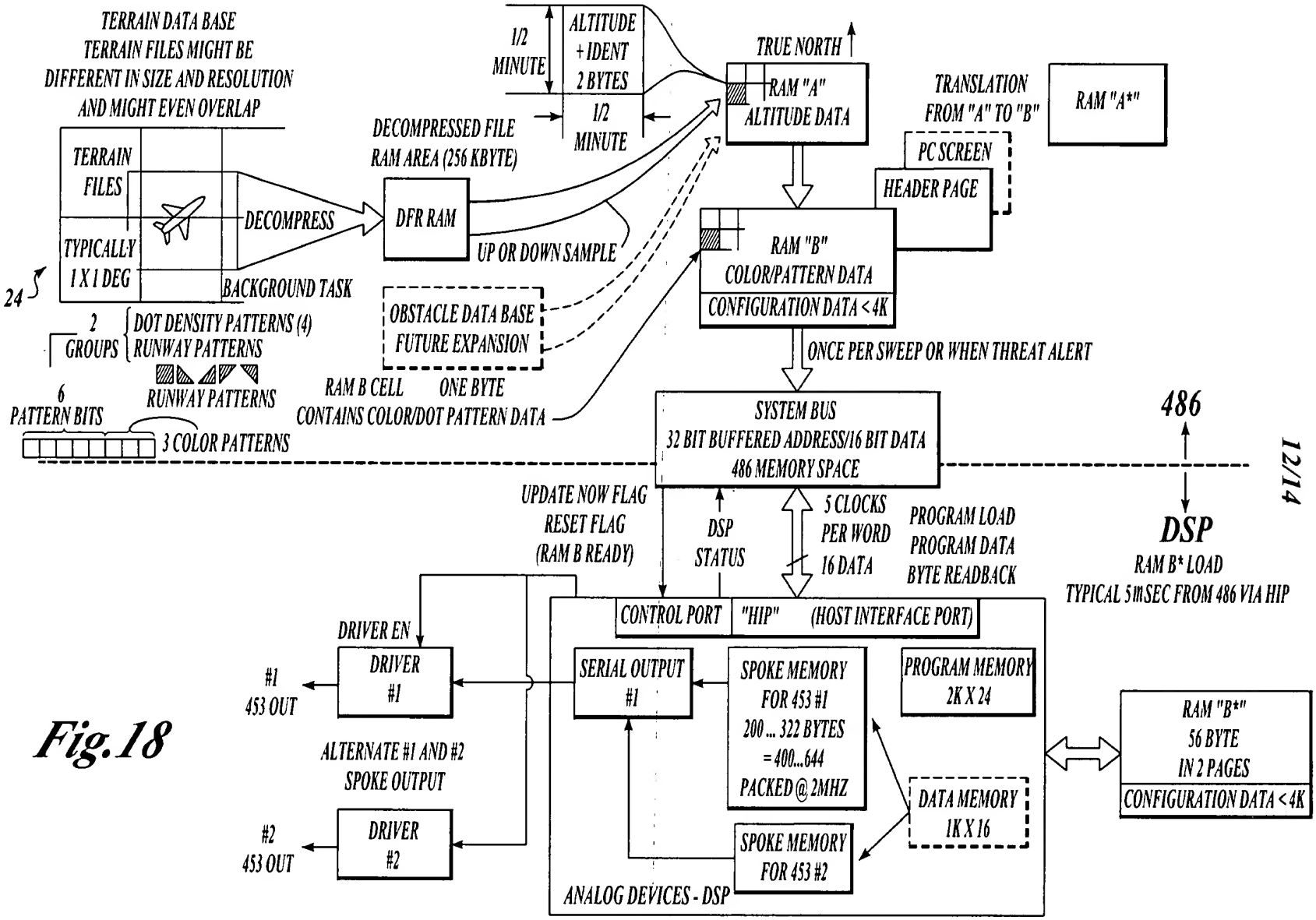
TERRAIN DATA BASE
TERRAIN FILES MIGHT BE
DIFFERENT IN SIZE AND RESOLUTION
AND MIGHT EVEN OVERLAP
TERRAIN FILES
TYPICALLY 1 X 1 DEG
24
DECOMPRESS
BACKGROUND TASK
2 GROUPS
DOT DENSITY PATTERNS (4)
RUNWAY PATTERNS
RUNWAY PATTERNS
6 PATTERN BITS
3 COLOR PATTERNS
DECOMPRESSED FILE
RAM AREA (256 KBYTE)
DFR RAM
UP OR DOWN SAMPLE
1/2 MINUTE
ALTITUDE + IDENT 2 BYTES
1/2 MINUTE
TRUE NORTH
RAM "A"
ALTITUDE DATA
TRANSLATION FROM "A" TO "B"
RAM "A*"
PC SCREEN
HEADER PAGE
RAM "B"
COLOR/PATTERN DATA
CONFIGURATION DATA < 4K
OBSTACLE DATA BASE
FUTURE EXPANSION
RAM B CELL ONE BYTE
CONTAINS COLOR/DOT PATTERN DATA
ONCE PER SWEEP OR WHEN THREAT ALERT
SYSTEM BUS
32 BIT BUFFERED ADDRESS/16 BIT DATA
486 MEMORY SPACE
486
UPDATE NOW FLAG
RESET FLAG
(RAM B READY)
DSP STATUS
5 CLOCKS PER WORD 16 DATA
PROGRAM LOAD
PROGRAM DATA
BYTE READBACK
DSP
RAM B* LOAD
TYPICAL 5 mSEC FROM 486 VIA HIP
CONTROL PORT
"HIP" (HOST INTERFACE PORT)
DRIVER EN
DRIVER #1
#1 453 OUT
SERIAL OUTPUT #1
SPOKE MEMORY FOR 453 #1
200 ... 322 BYTES
= 400...644
PACKED @ 2MHZ
PROGRAM MEMORY
2K X 24
RAM "B*"
56 BYTE
IN 2 PAGES
CONFIGURATION DATA < 4K
ALTERNATE #1 AND #2
SPOKE OUTPUT
DATA MEMORY
1K X 16
#2 453 OUT
DRIVER #2
SPOKE MEMORY FOR 453 #2
ANALOG DEVICES - DSP

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Fig. 18

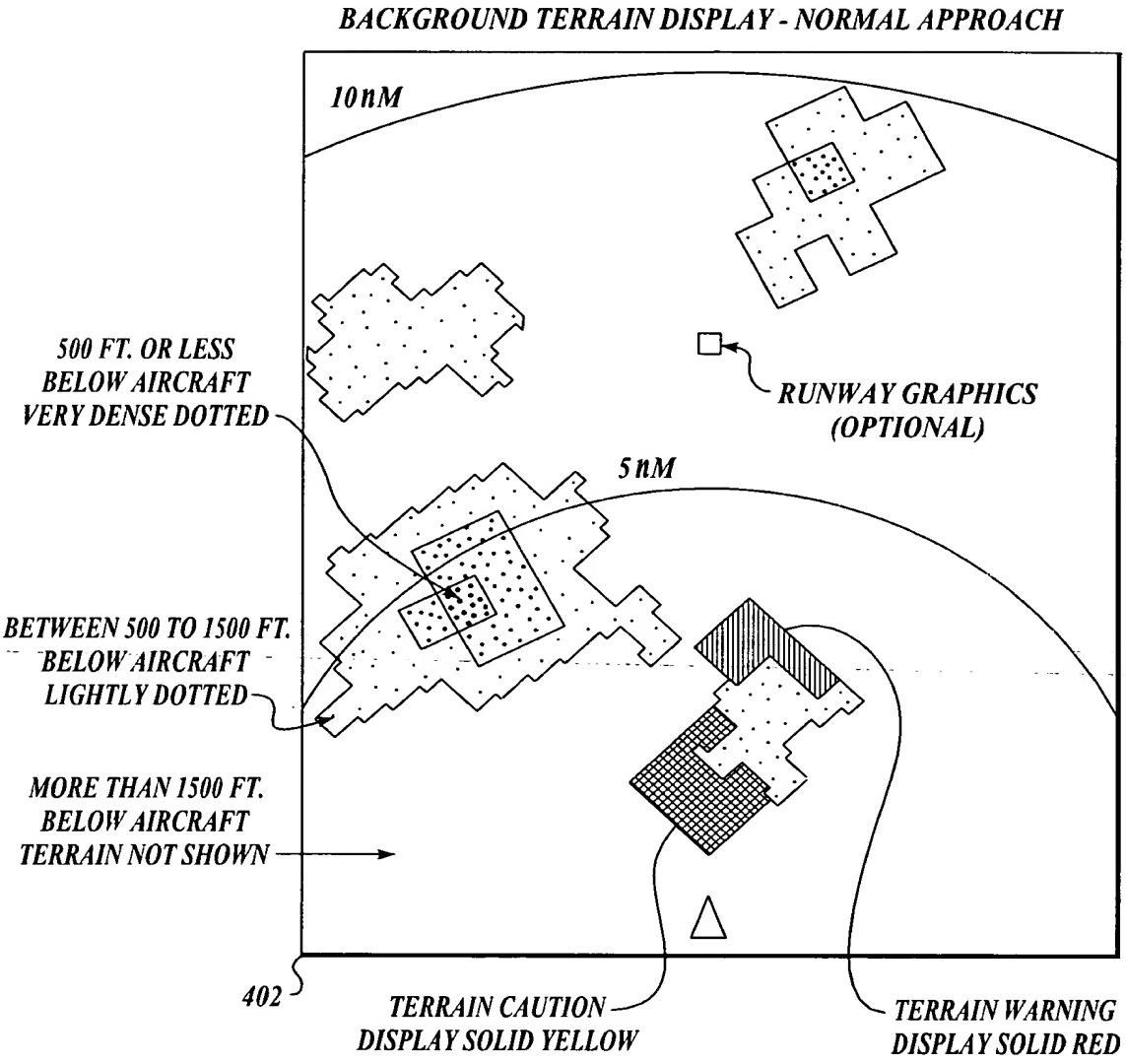
BACKGROUND TERRAIN DISPLAY - NORMAL APPROACH
10nM
5nM
500 FT. OR LESS
BELOW AIRCRAFT
VERY DENSE DOTTED
RUNWAY GRAPHICS
(OPTIONAL)
BETWEEN 500 TO 1500 FT.
BELOW AIRCRAFT
LIGHTLY DOTTED
MORE THAN 1500 FT.
BELOW AIRCRAFT
TERRAIN NOT SHOWN
402
TERRAIN CAUTION
DISPLAY SOLID YELLOW
TERRAIN WARNING
DISPLAY SOLID RED

Fig. 19

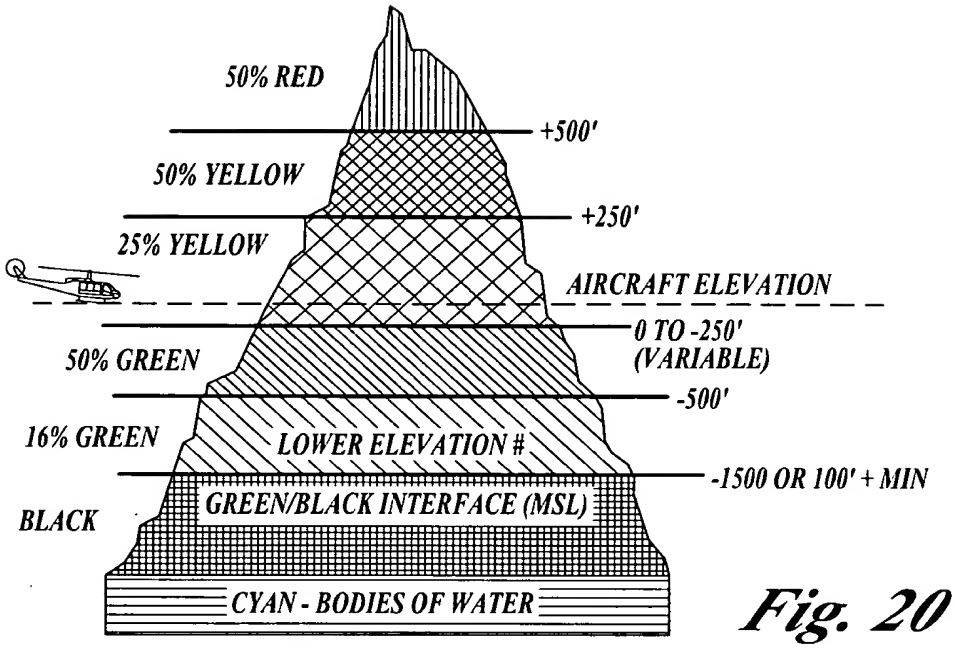
50% RED
+500'
50% YELLOW
+250'
25% YELLOW
AIRCRAFT ELEVATION
0 TO -250'
(VARIABLE)
50% GREEN
-500'
16% GREEN
LOWER ELEVATION #
-1500 OR 100' + MIN
BLACK
GREEN/BLACK INTERFACE (MSL)
CYAN - BODIES OF WATER

Fig. 20

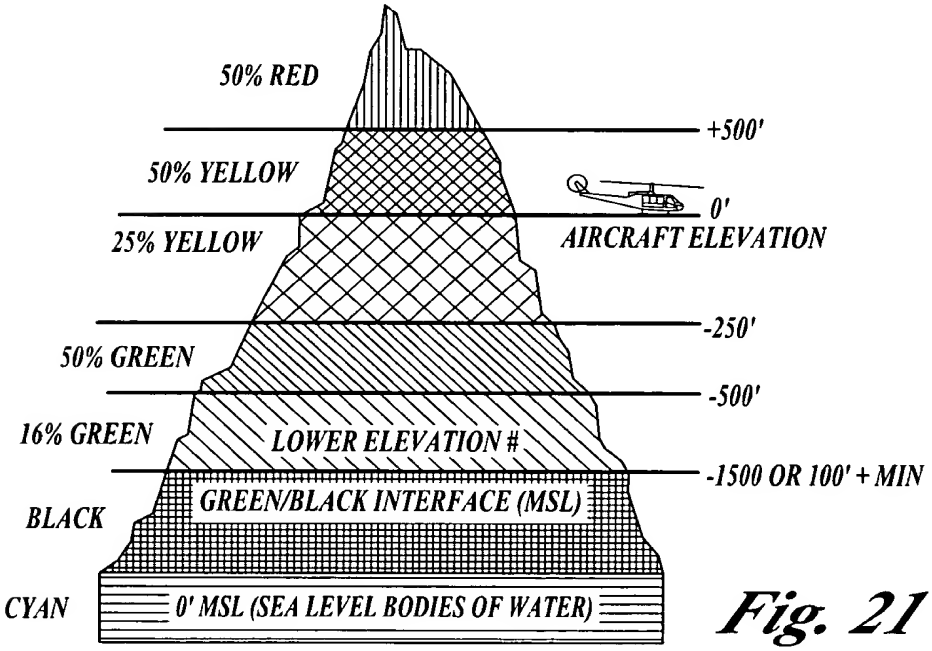
50% RED
+500'
50% YELLOW
0'
25% YELLOW
AIRCRAFT ELEVATION
-250'
50% GREEN
-500'
16% GREEN
LOWER ELEVATION #
-1500 OR 100' + MIN
BLACK
GREEN/BLACK INTERFACE (MSL)
CYAN
0' MSL (SEA LEVEL BODIES OF WATER)

Fig. 21